

## **The Combined Use of Open-Path Fourier Transform Spectroscopy and Multispectral Thermal Infrared Imaging to Map Volcanic Sulfur Dioxide Plumes**

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On December 9, 1996, NASA's DC-8 research aircraft flew over the Pu'u 'O'o vent of Kilauea Volcano, Hawaii. The DC-8 instrument payload included the Airborne Emission Spectrometer (AES) and Thermal Infrared Multispectral Scanner (TIMS). The AES and TIMS data were used to map the SO<sub>2</sub> plume emanating from the Pu'u 'O'o vent.

The spectrum of SO<sub>2</sub> contains features between 8 and 9 micrometers (μm) that can be exploited by AES and TIMS to estimate SO<sub>2</sub> concentrations. AES is an open-path Fourier Transform spectrometer (FTS) that can acquire radiance measurements in over 54,000 spectral channels between 2.4 and 15.4 μm. TIMS is an imaging instrument that acquires radiance measurements in six spectral channels between 8 and 12 μm. The AES data provides information on the vertical structure of the Pu'u 'O'o plume and local atmosphere while TIMS data provides information on the horizontal structure of the plume.

Independent retrievals of SO<sub>2</sub> concentration and ground temperature estimates from the AES and TIMS data were compared in an attempt to corroborate the retrieval algorithms. The close agreement between these retrievals motivates the combination of the data sets in the next phase of analysis. Estimates of ground emissivity derived from the TIMS data will be input to the AES SO<sub>2</sub> retrieval algorithm and profiles of atmospheric water vapor derived from the AES data will be input to the TIMS retrieval algorithm.

Mapping plumes with profiling and imaging instruments may become more routine in the 21<sup>st</sup> century. The payloads of NASA's series of Earth Observing System satellites will include multispectral infrared imaging instruments (with launches scheduled for 1999, 2000, 2004, and 2006), an FTS (2002 launch), and an infrared atmospheric sounder (2006 launch). The present work with AES and TIMS data will help to define the tools and procedures necessary to analyze these future data sets.

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